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FIG. 1 is a schematic diagram of a prior art device 100. The device 100 includes a base 102, a support 104, and a top 106. The base 102 is a rectangular block with a top surface 108 and a bottom surface 110. The support 104 is a vertical member extending from the top surface 108 of the base 102. The top 106 is a horizontal member extending from the support 104. The device 100 is shown in a perspective view.

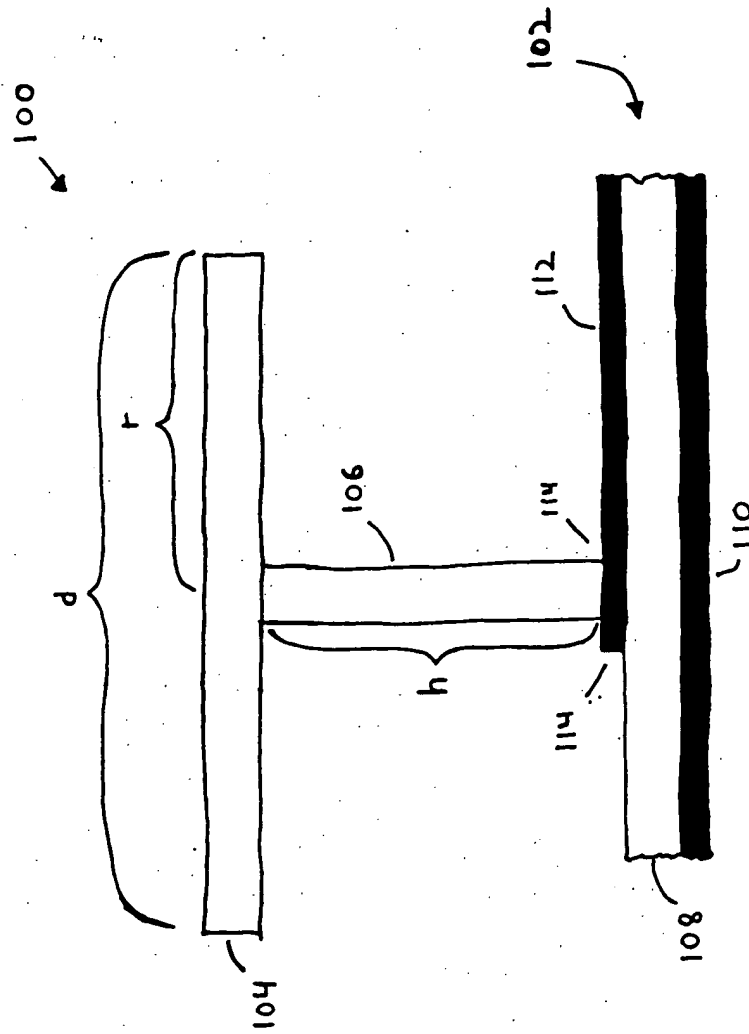
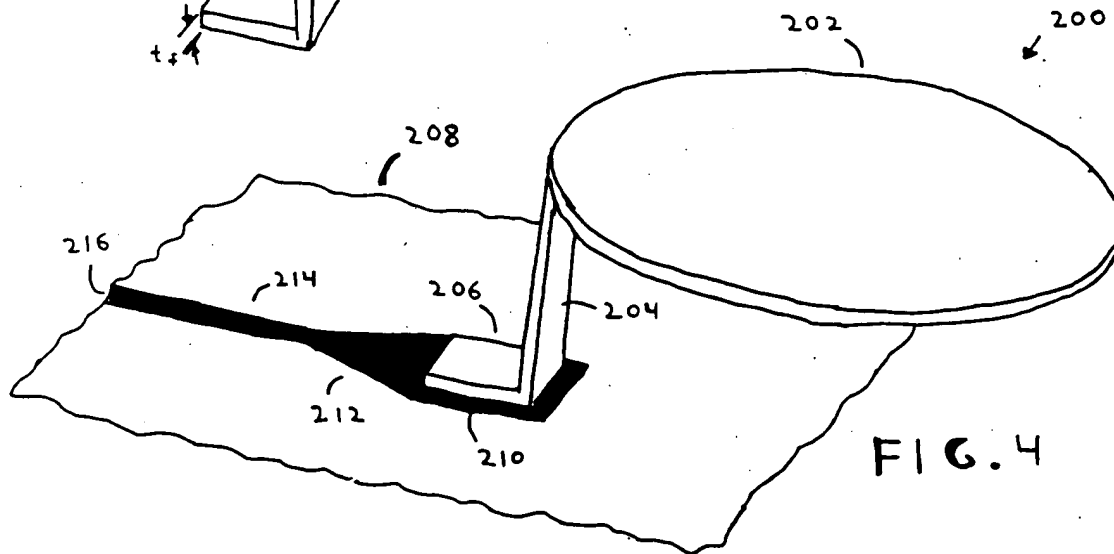
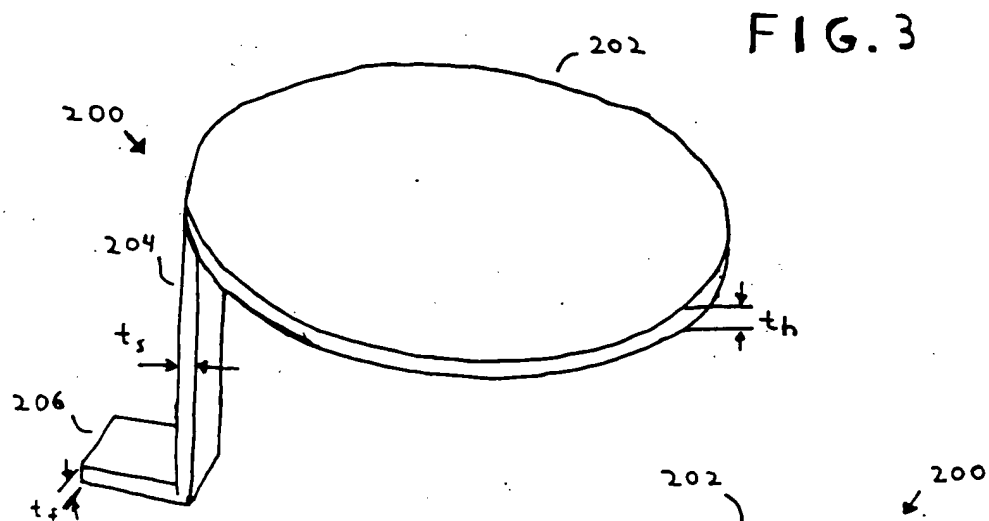
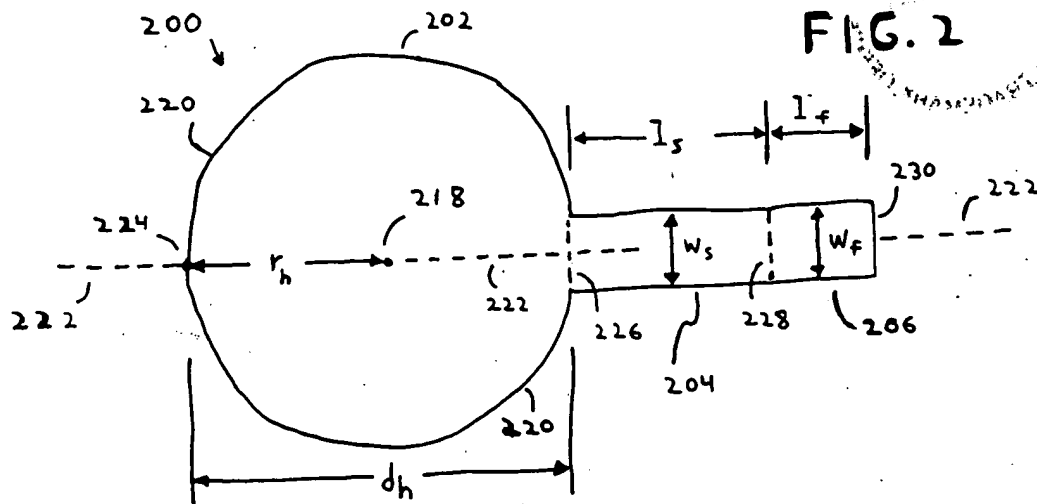


FIG. 1 PRIOR ART



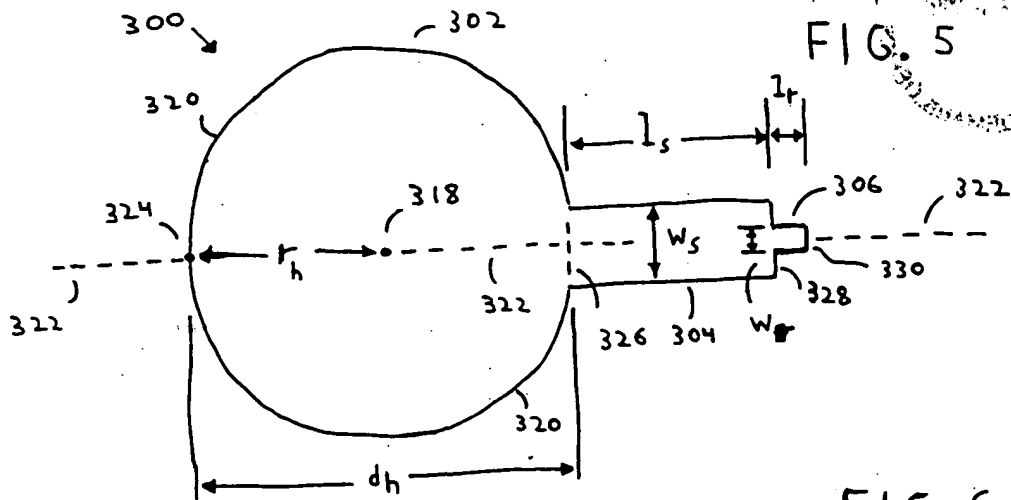


FIG. 6

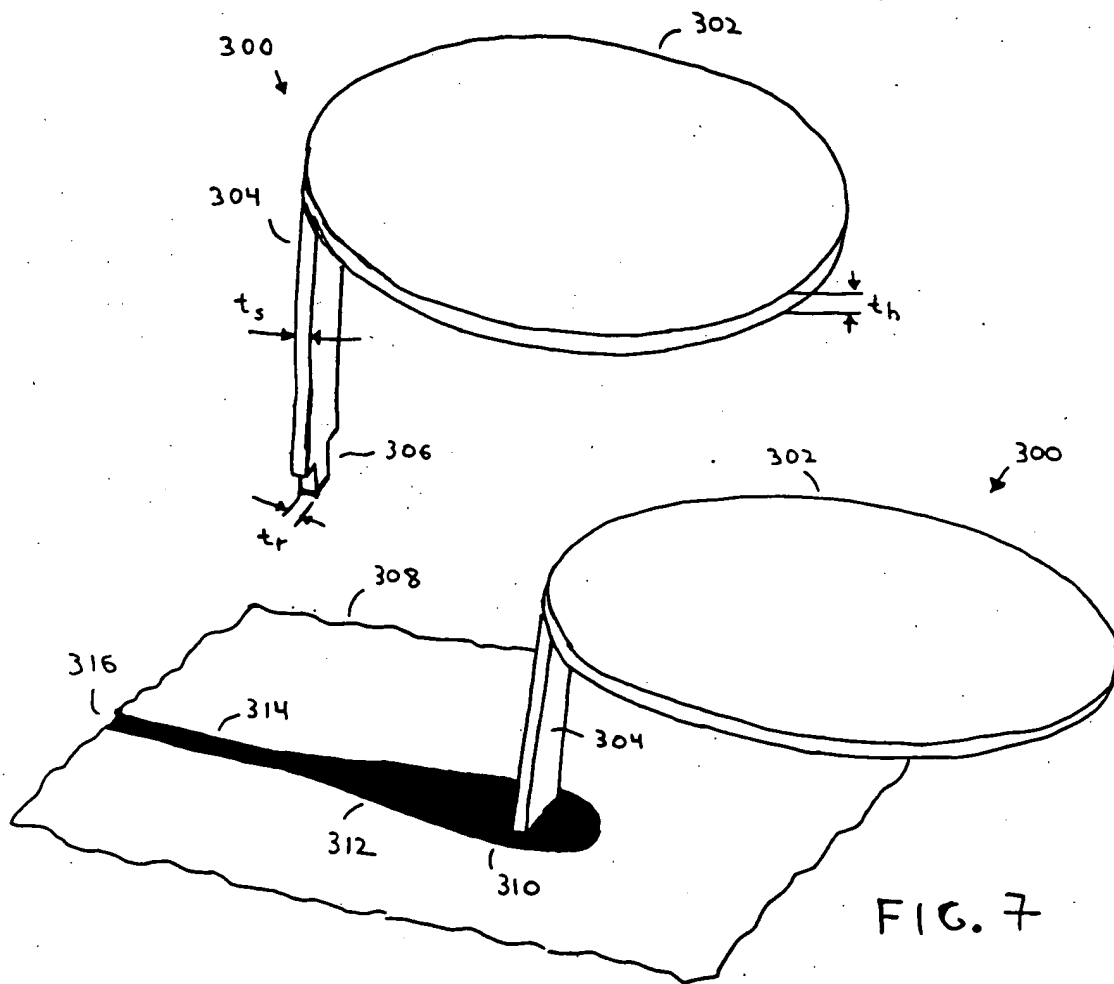
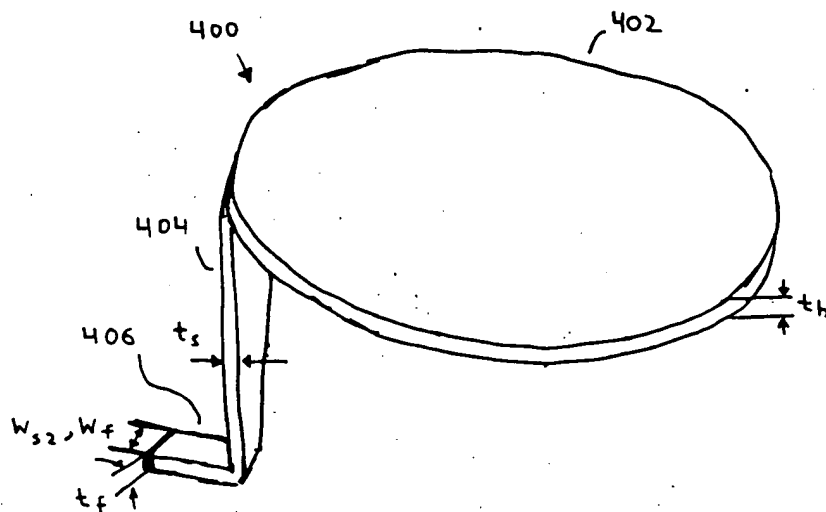
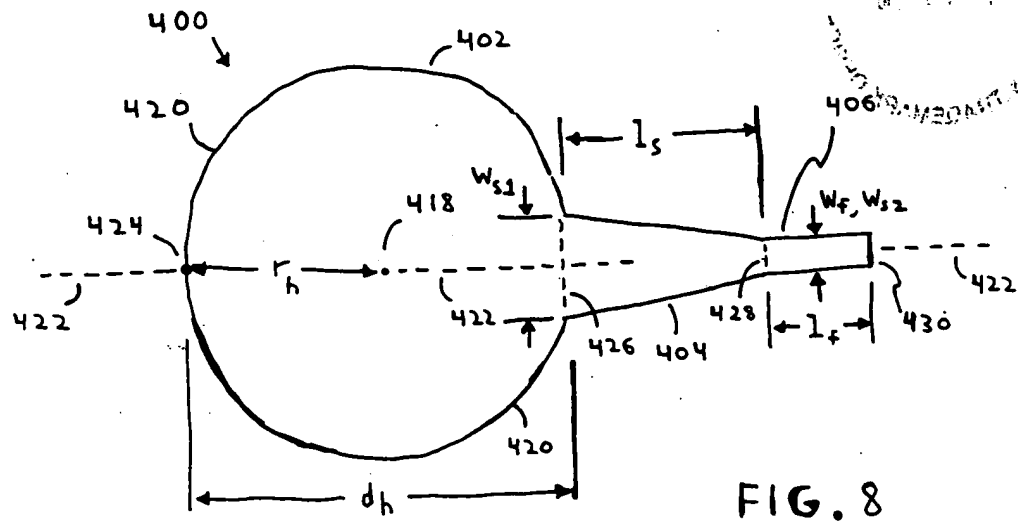


FIG. 7



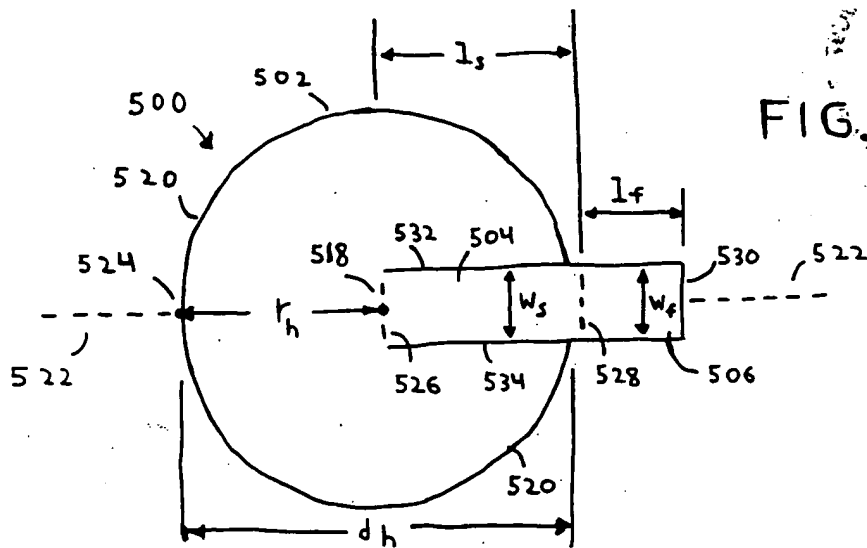


FIG. 10

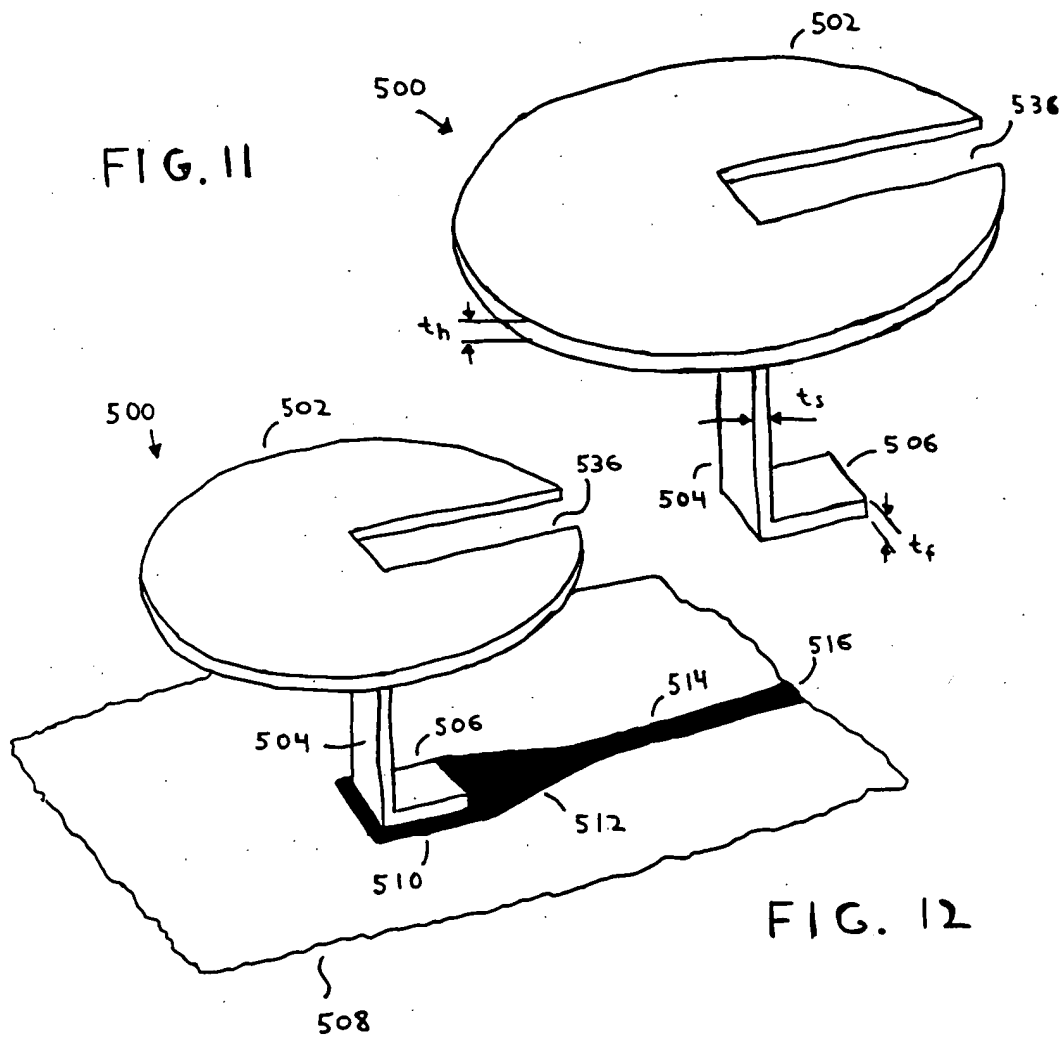
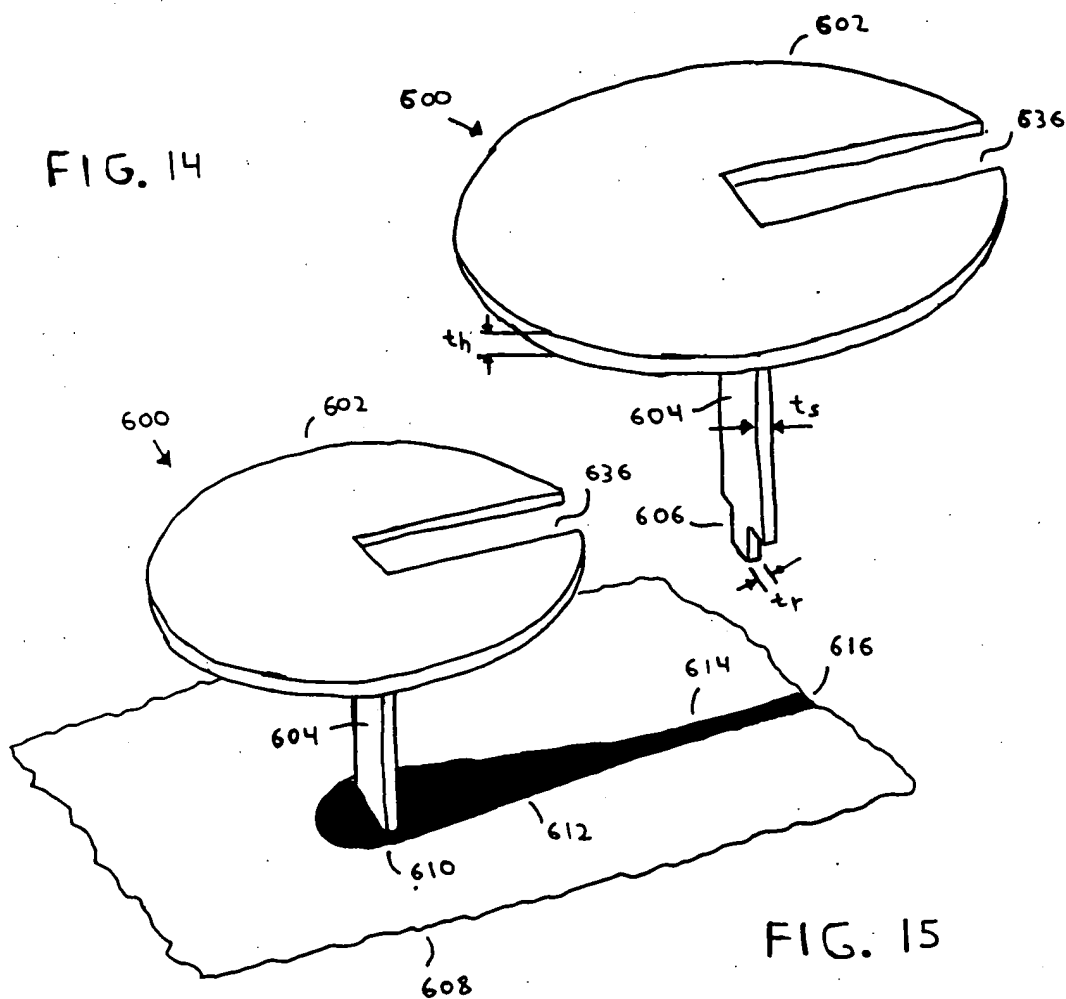
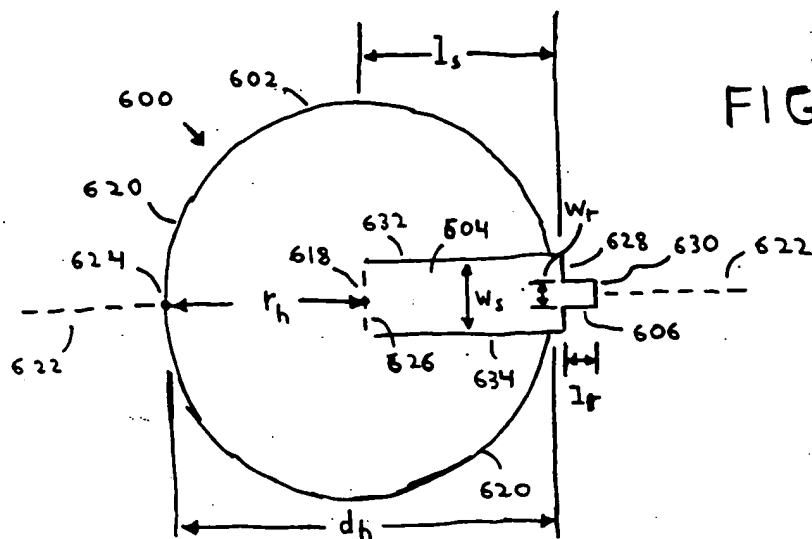


FIG. 12



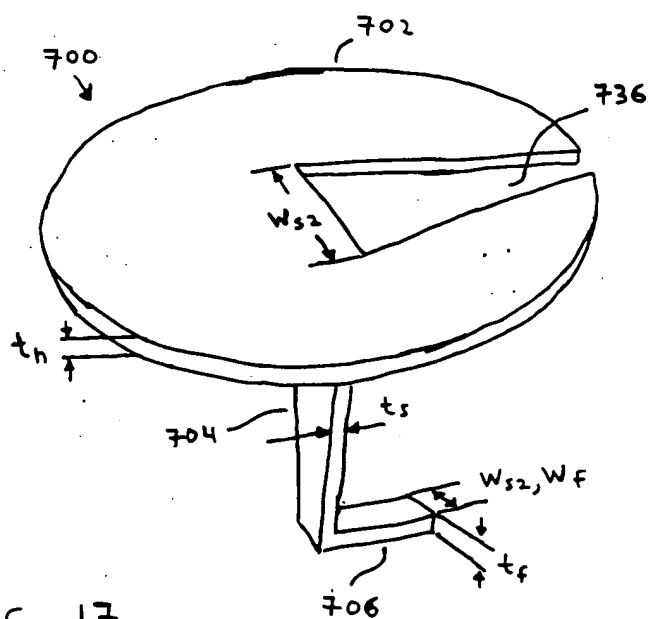
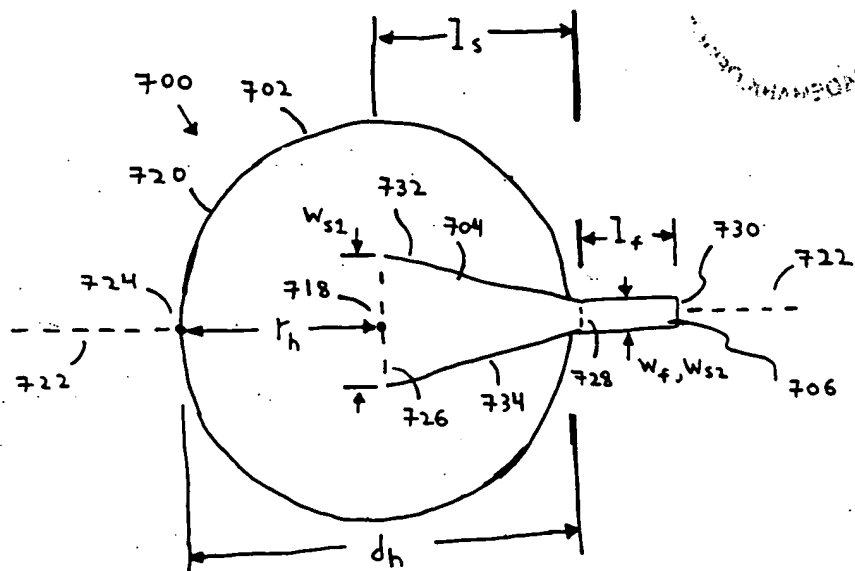




FIG. 18

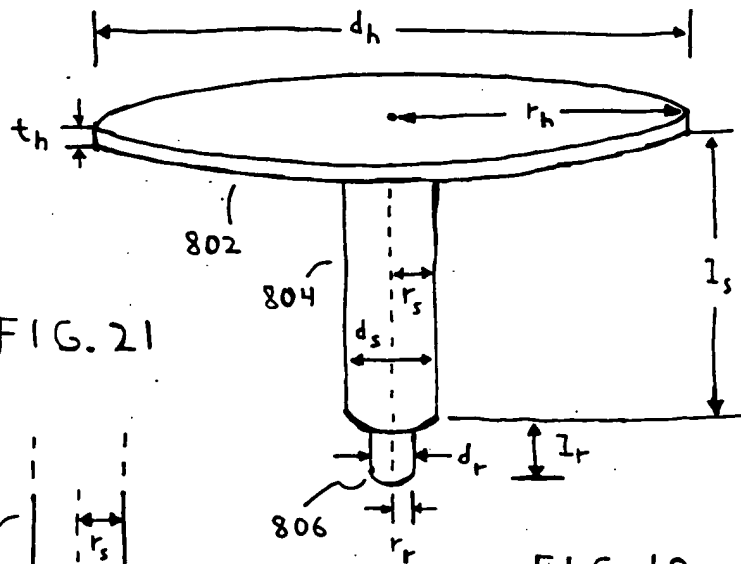
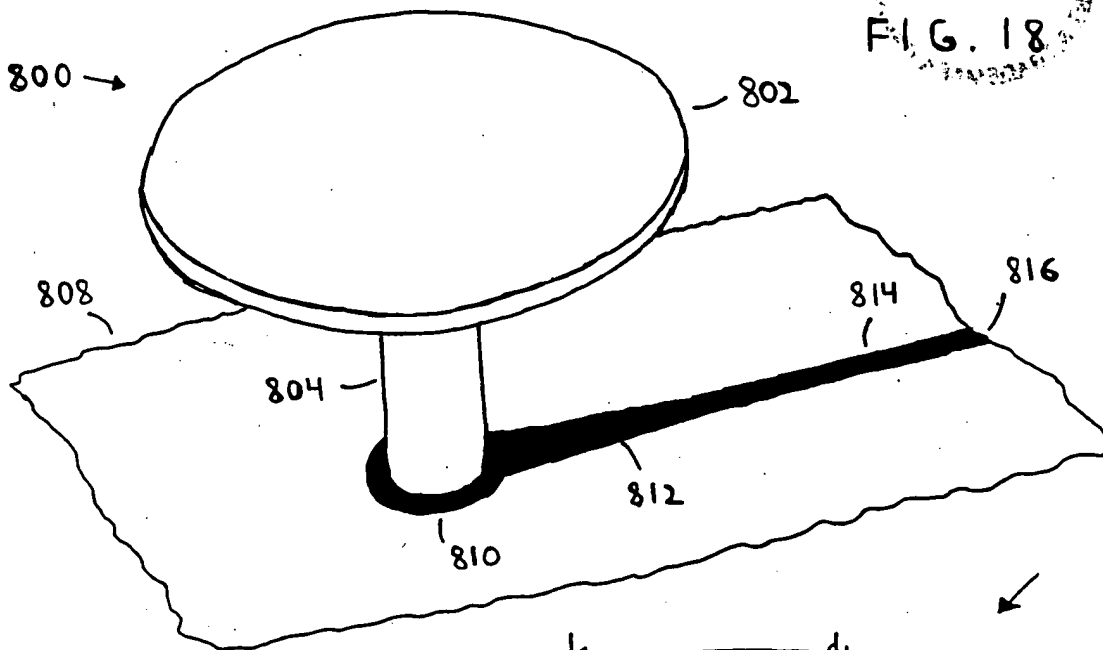


FIG. 19

FIG. 20

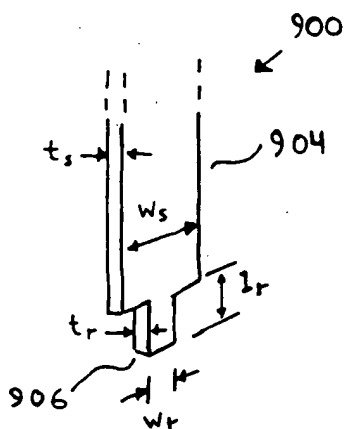
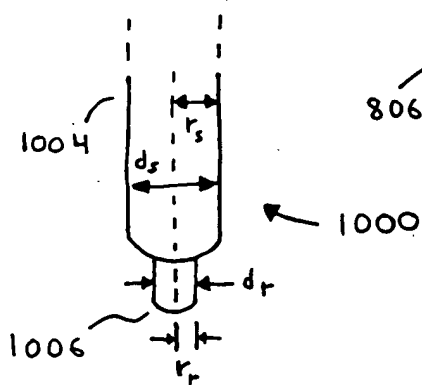


FIG. 21



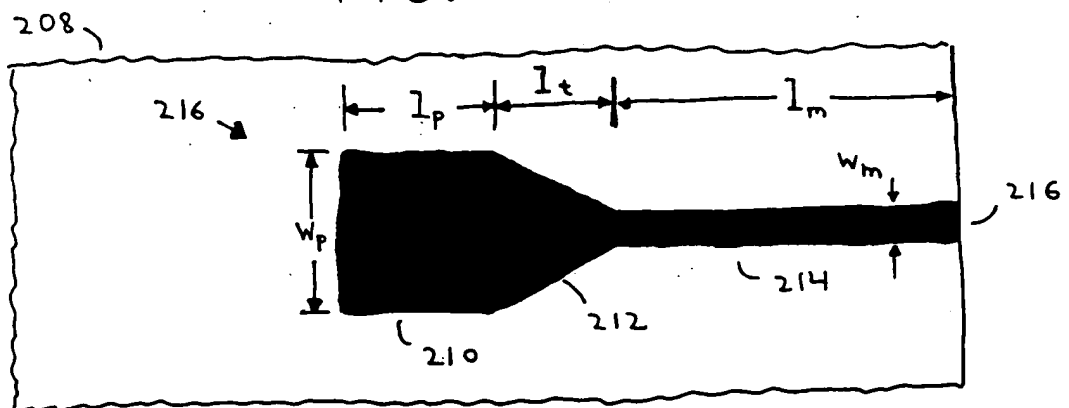
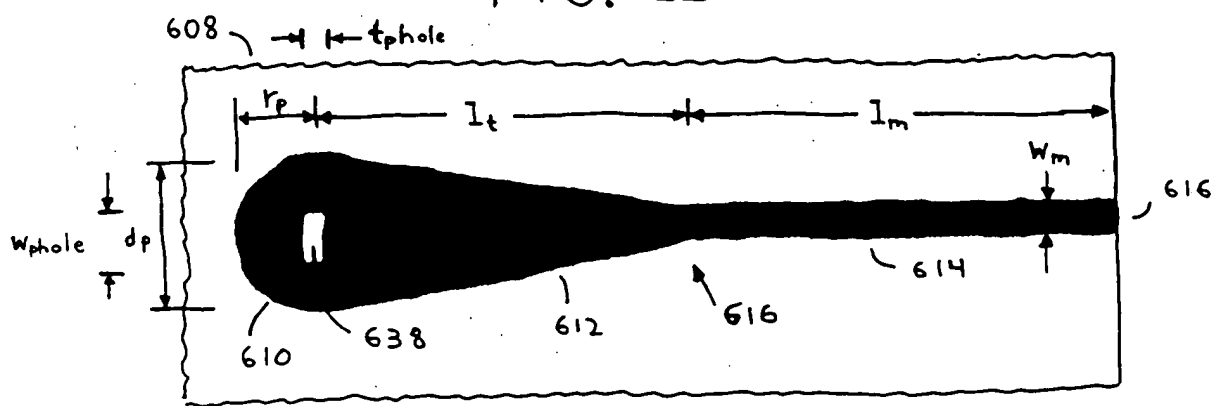
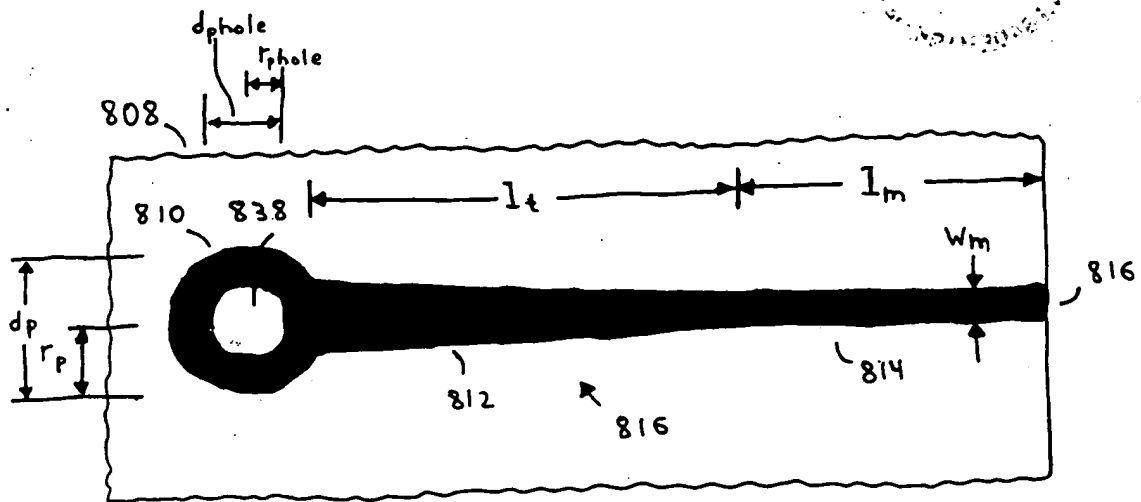


FIG. 25

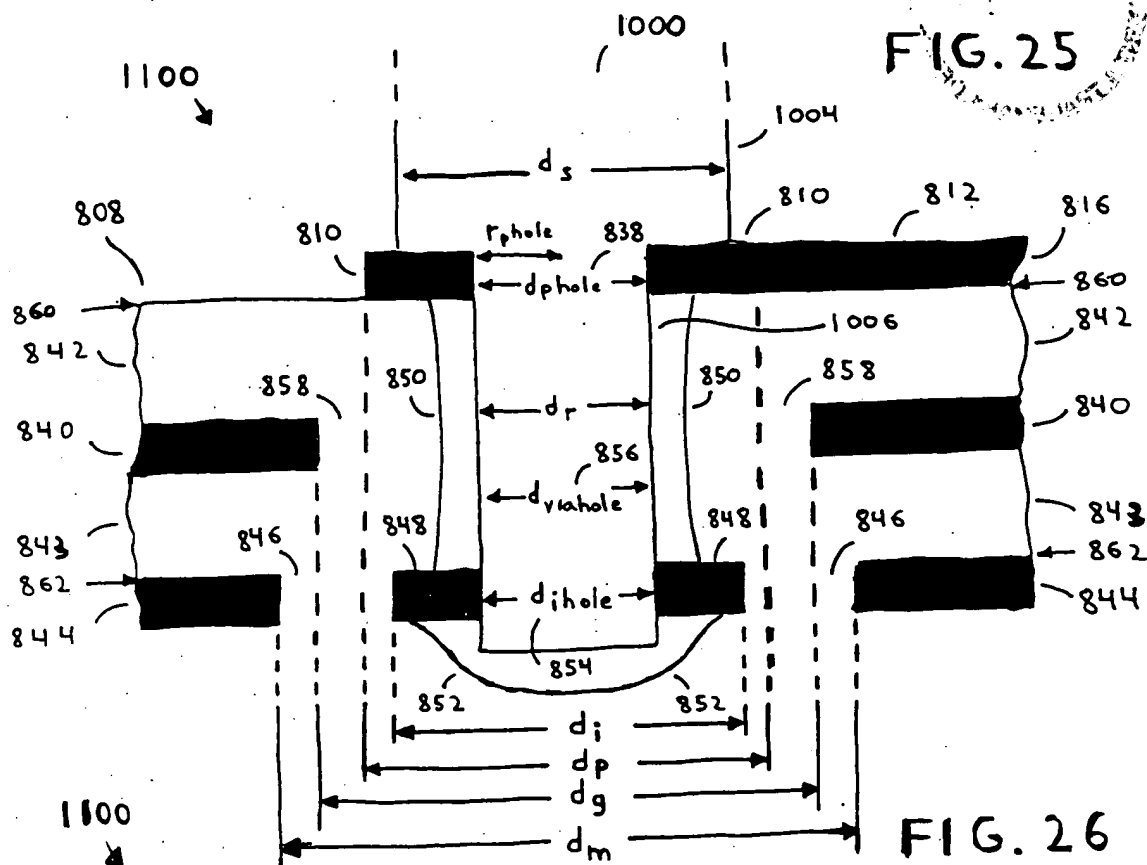


FIG. 26

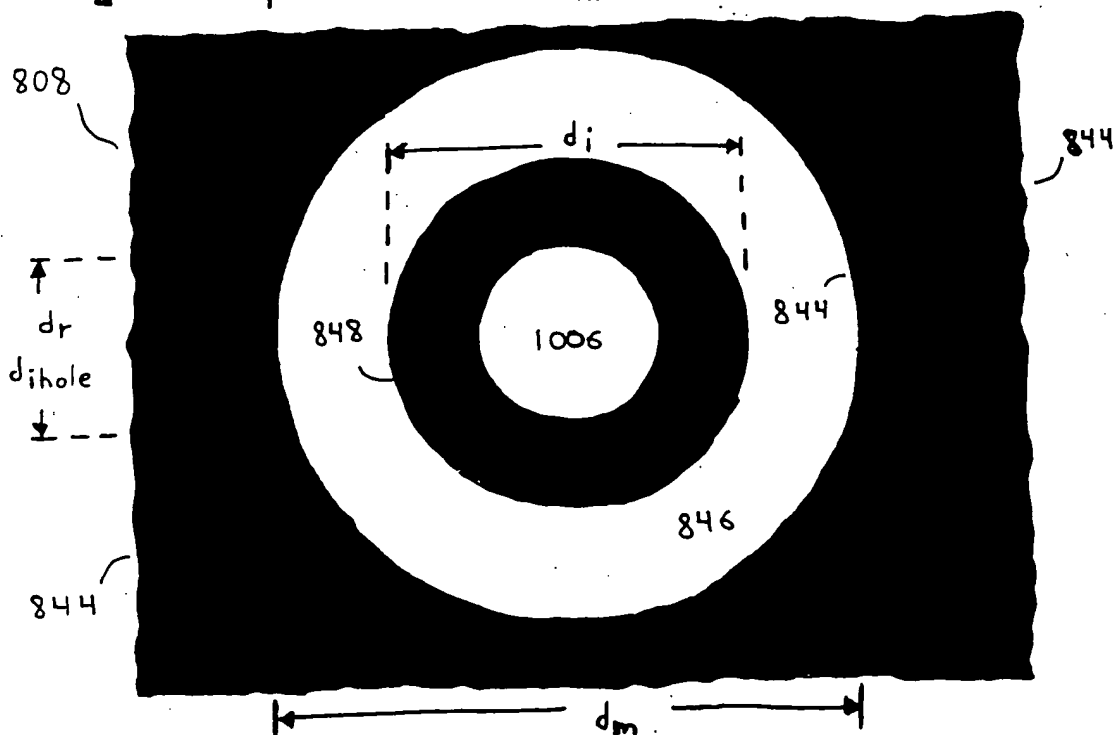
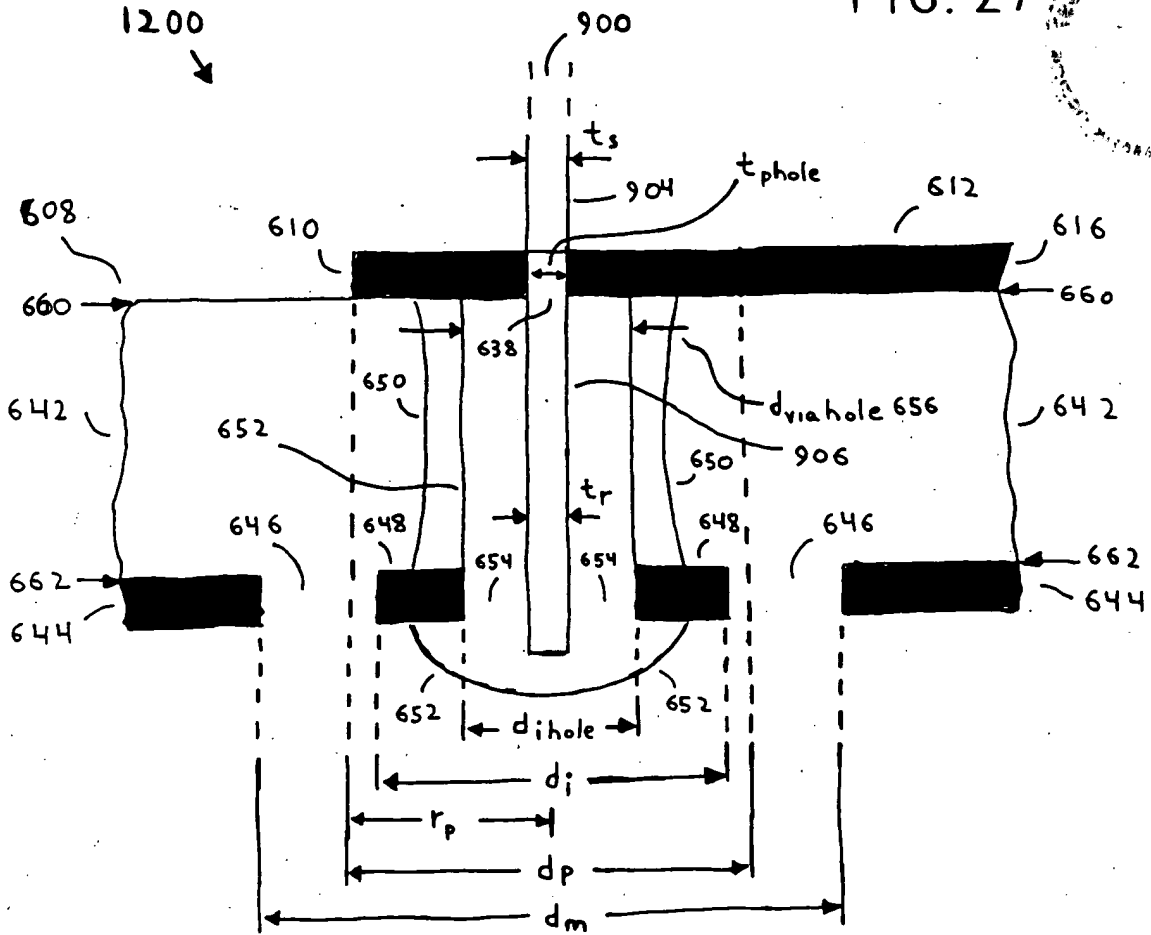


FIG. 27



# Input Impedance

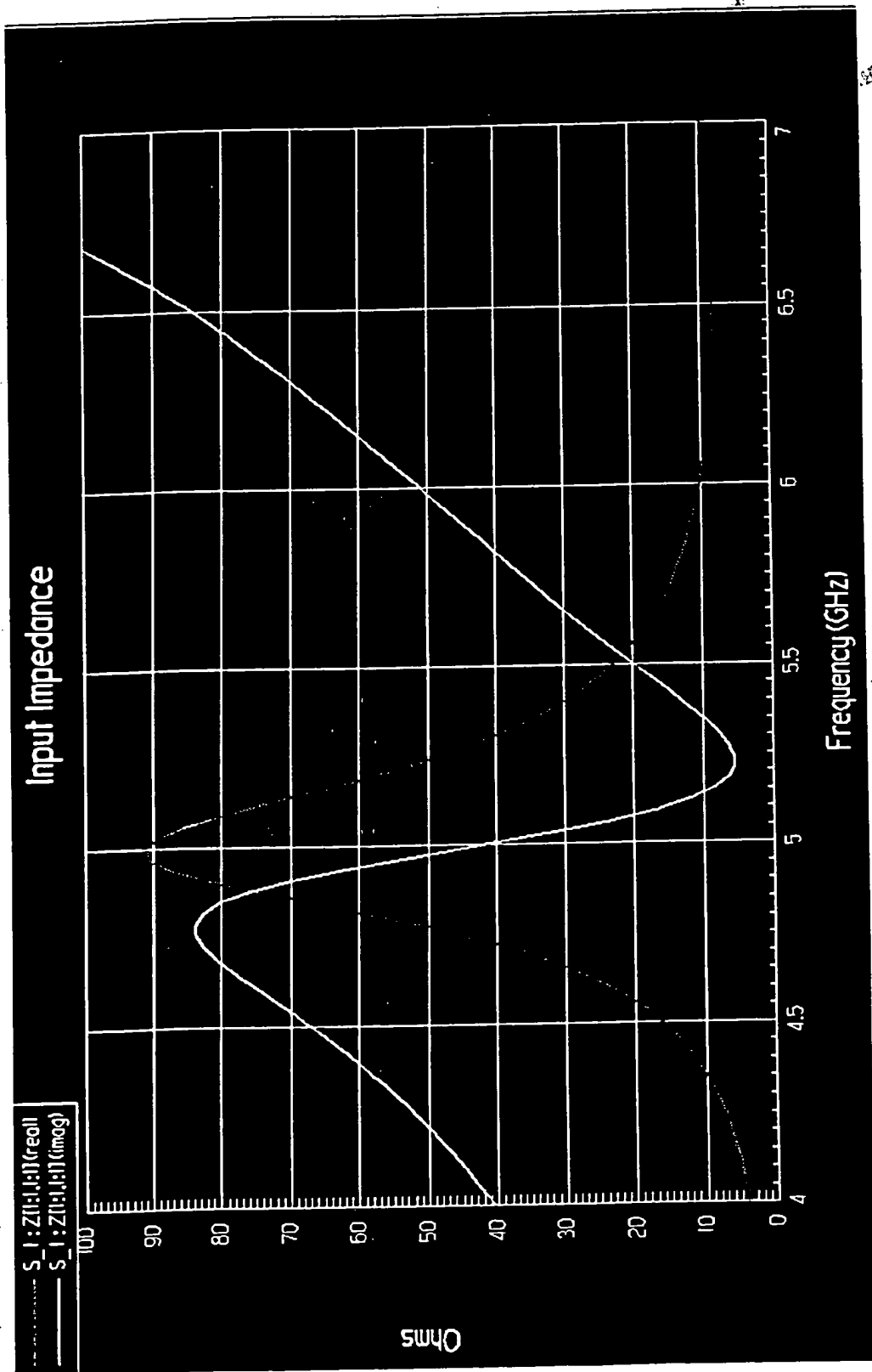


FIG. 28

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# 50 ohm VSWR

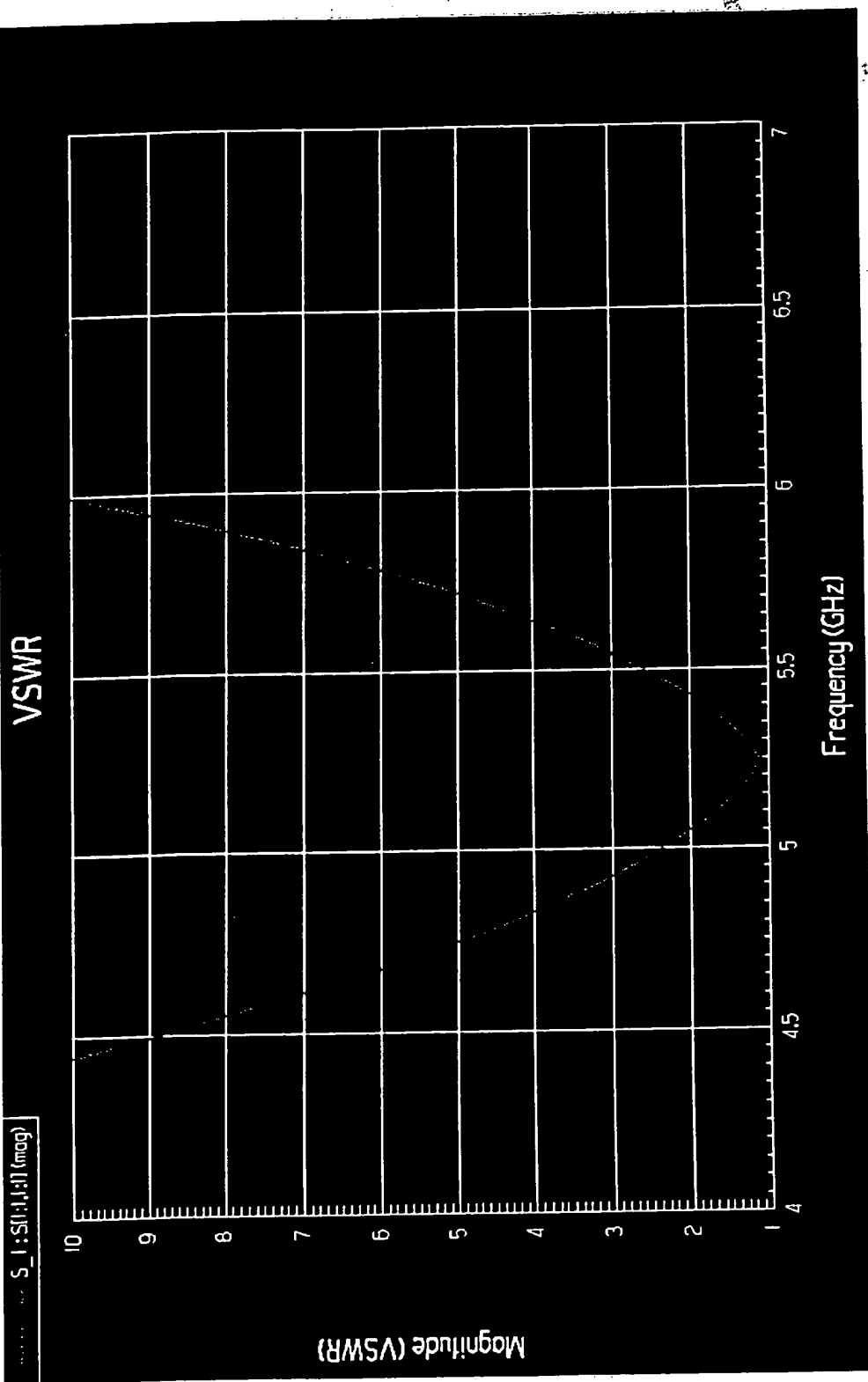


FIG. 29

50 ohm VSWR

# 50 ohm VSWR

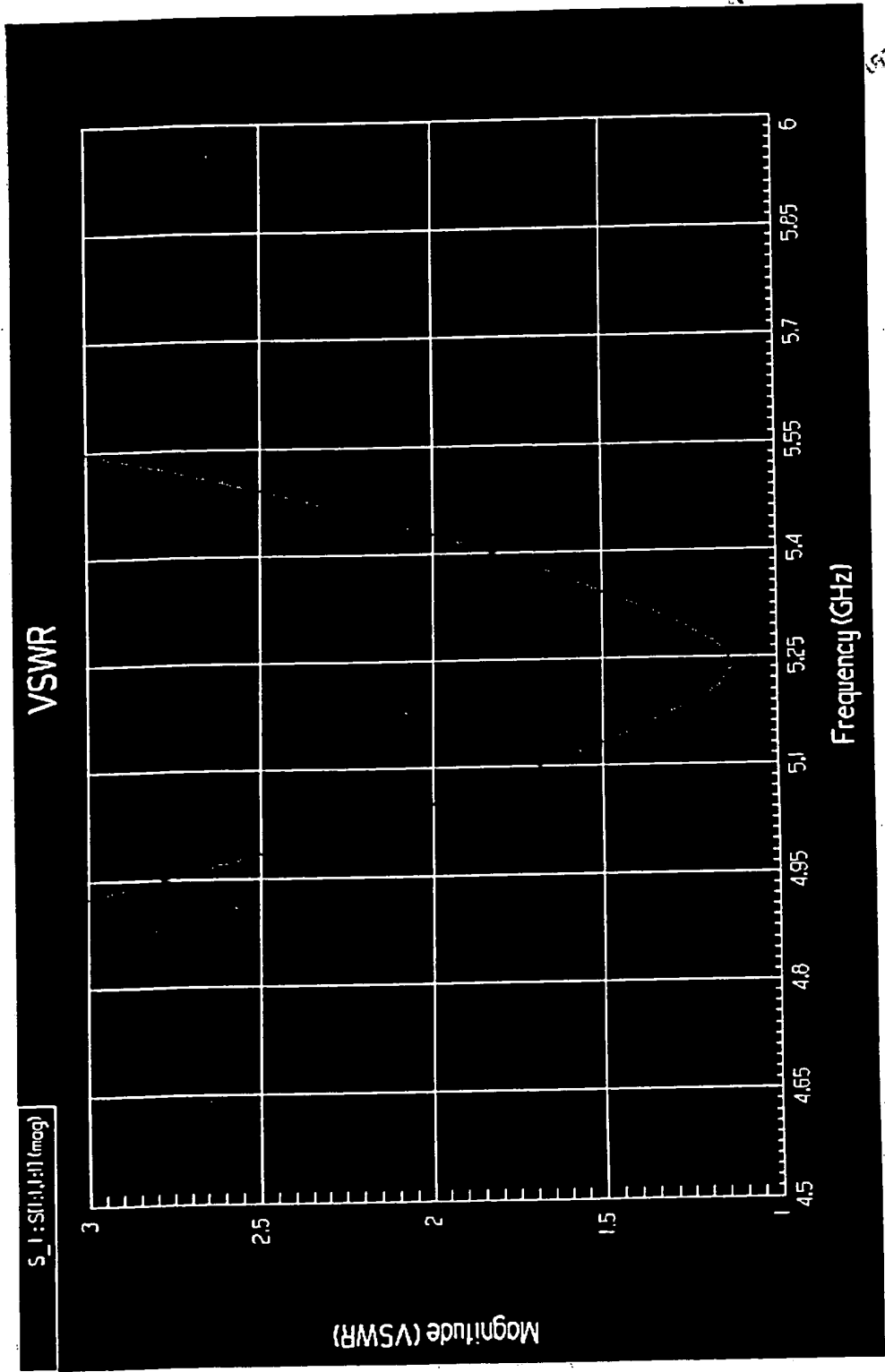


FIG. 30

1. The input impedance is calculated from the S-parameters of the device under test (DUT) using the following equation:  

$$Z_{in} = Z_0 \frac{1 + S_{11}}{1 - S_{11}}$$
 where  $Z_0$  is the characteristic impedance of the transmission line (50  $\Omega$ ), and  $S_{11}$  is the input reflection coefficient.  
 2. The input impedance is plotted as a function of frequency from 4 GHz to 7 GHz.  
 3. The real part of the input impedance is shown as a solid line, and the imaginary part is shown as a dashed line.  
 4. The real part of the input impedance starts at approximately 100  $\Omega$  at 4 GHz, increases to a peak of about 180  $\Omega$  at 5.2 GHz, and then decreases to about 100  $\Omega$  at 7 GHz.  
 5. The imaginary part of the input impedance starts at approximately -100  $\Omega$  at 4 GHz, increases to a peak of about -150  $\Omega$  at 5.2 GHz, and then decreases to about -100  $\Omega$  at 7 GHz.  
 6. The input impedance is purely resistive at approximately 4.8 GHz and 6.2 GHz, where the imaginary part is zero.

## Input Impedance

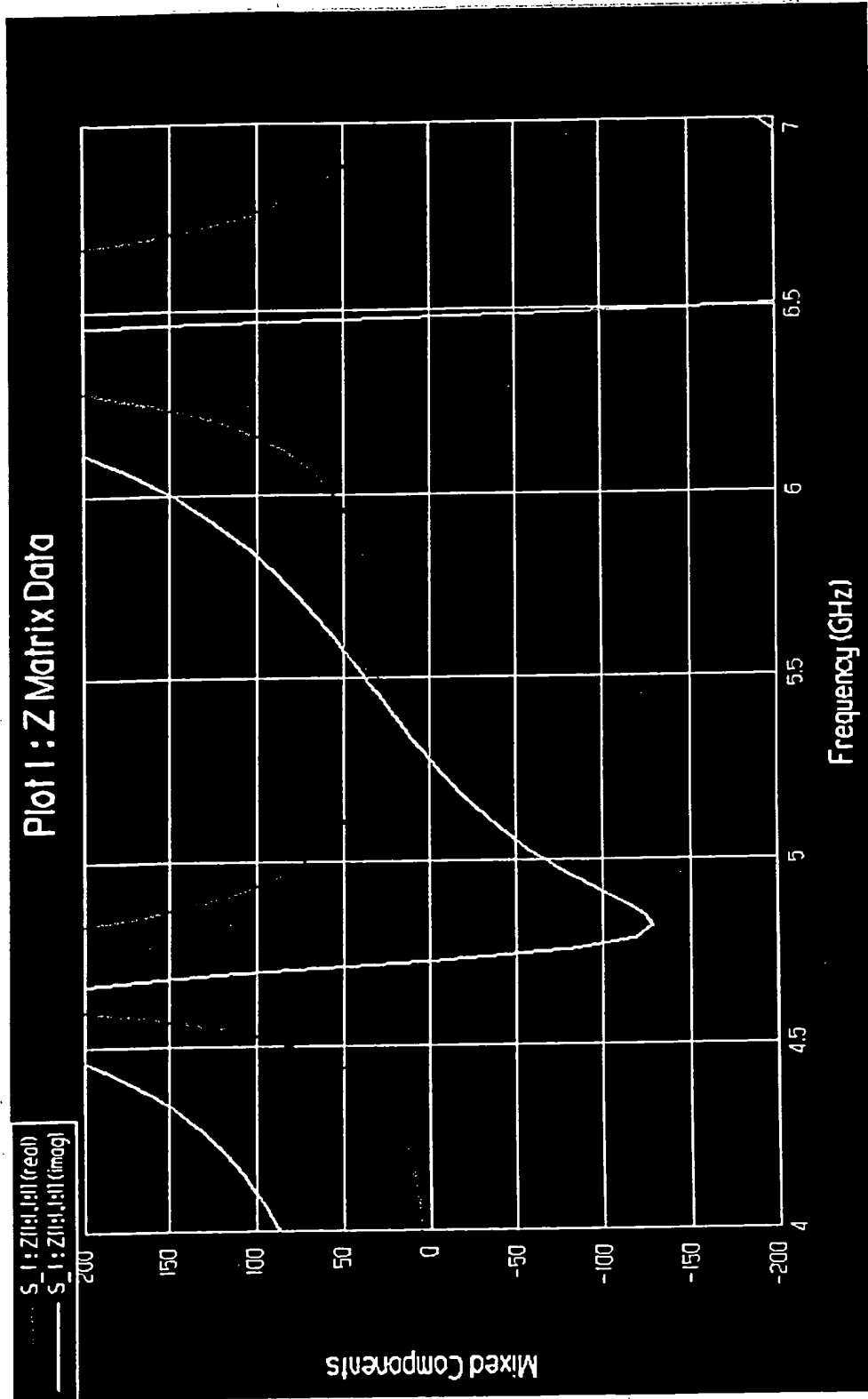


FIG. 31



The graph shows the variation of the voltage standing wave ratio (VSWR) with frequency for a 50 ohm load. The VSWR is plotted on a logarithmic scale from 1 to 10, and the frequency is plotted on a linear scale from 4 to 7 GHz. The curve shows a minimum VSWR of 1 at 4.5 GHz and a maximum VSWR of approximately 9.5 at 5.5 GHz.

# 50 ohm VSWR

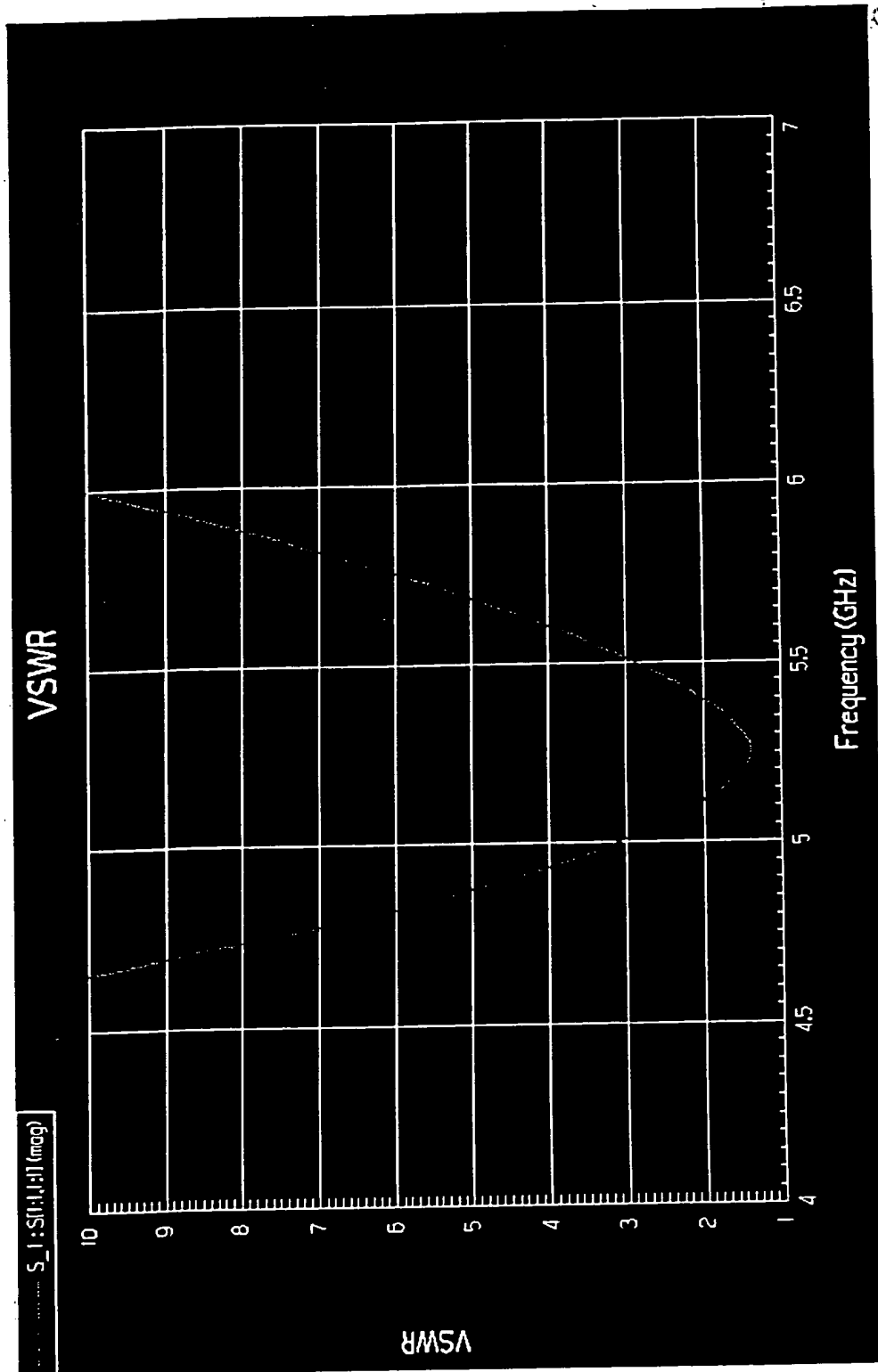


FIG. 32

50 ohm VSWR

# 50 ohm VSWR

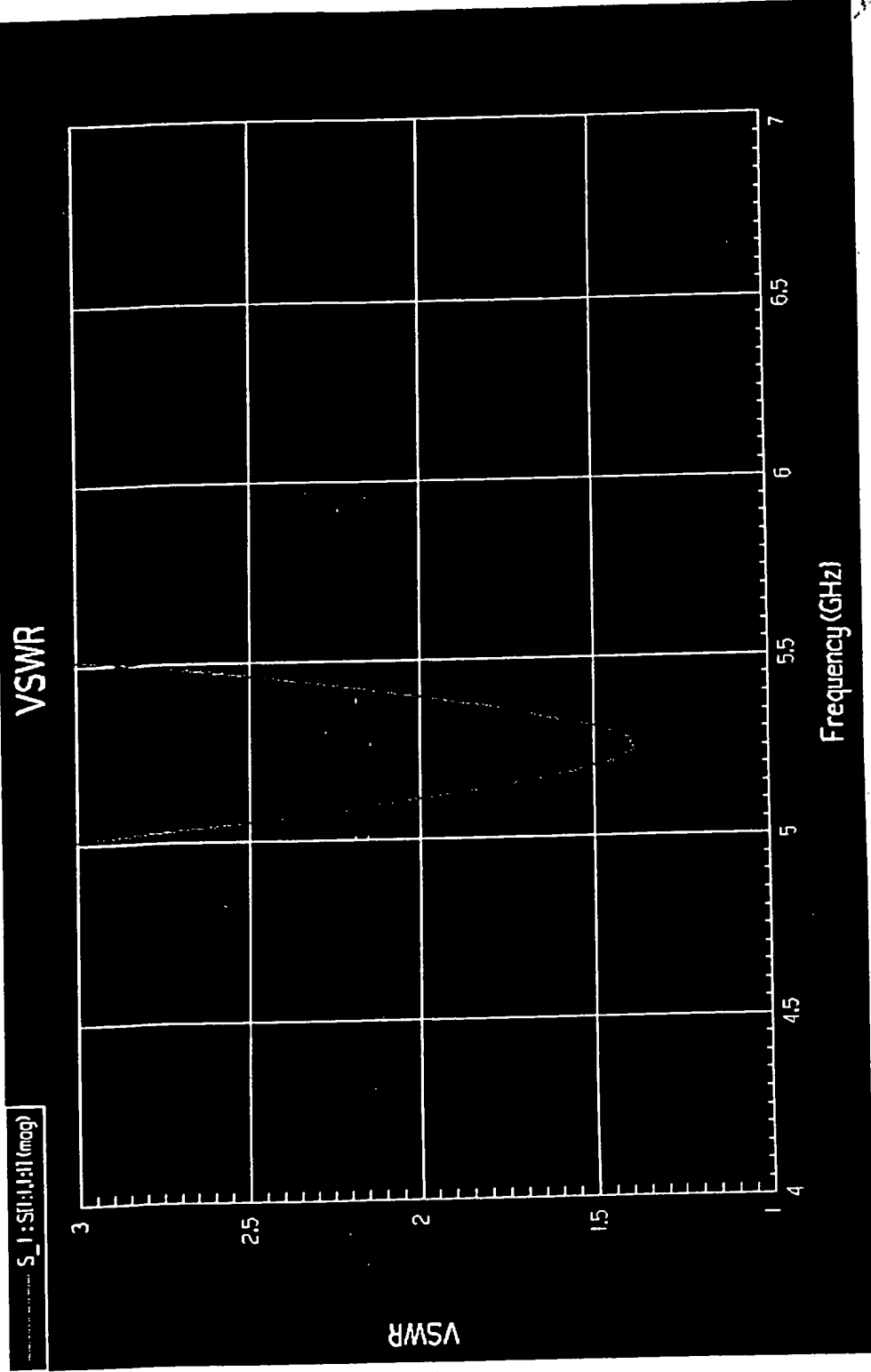


FIG. 33

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## Input Impedance

### Impedance for Top Hat Monopole

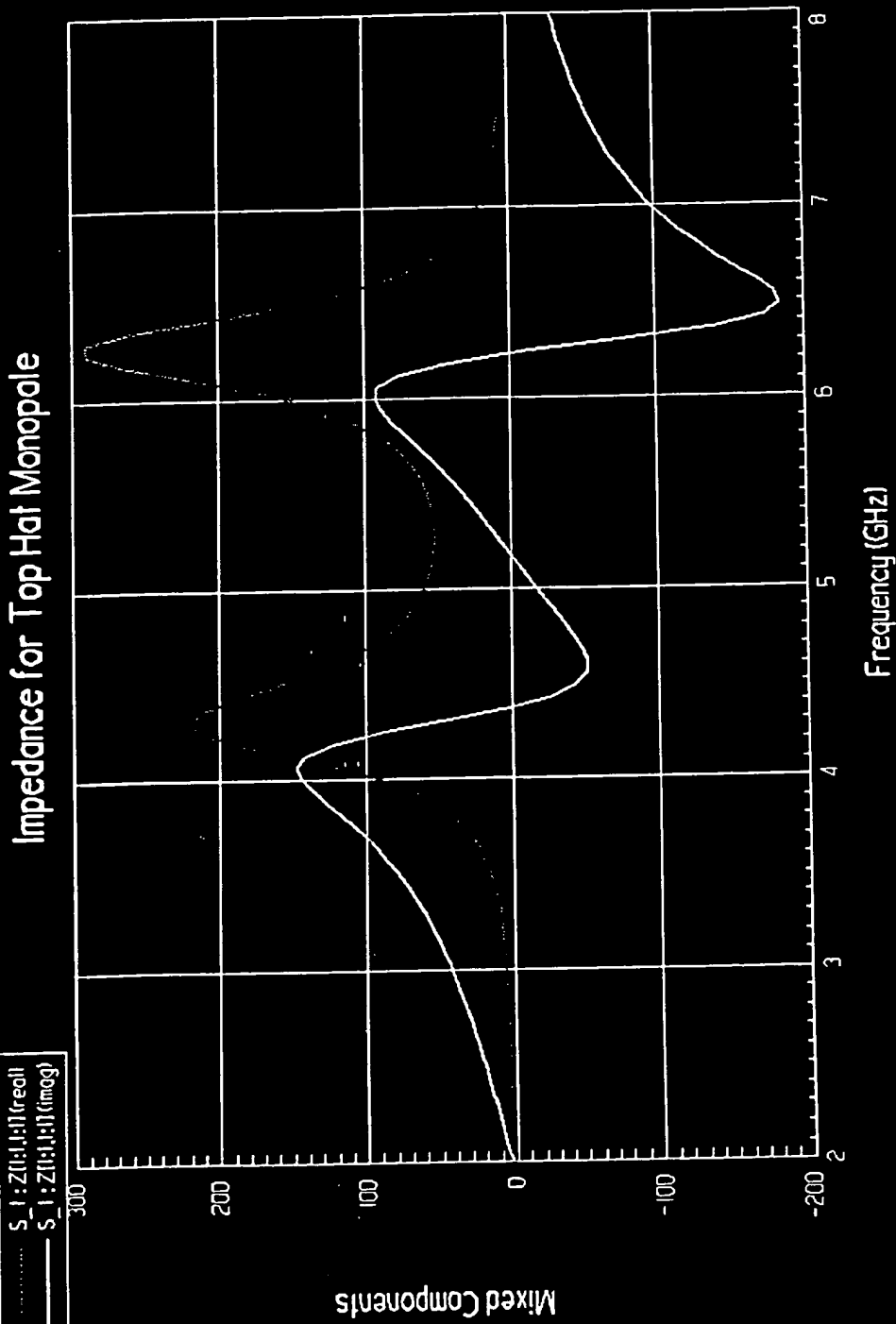
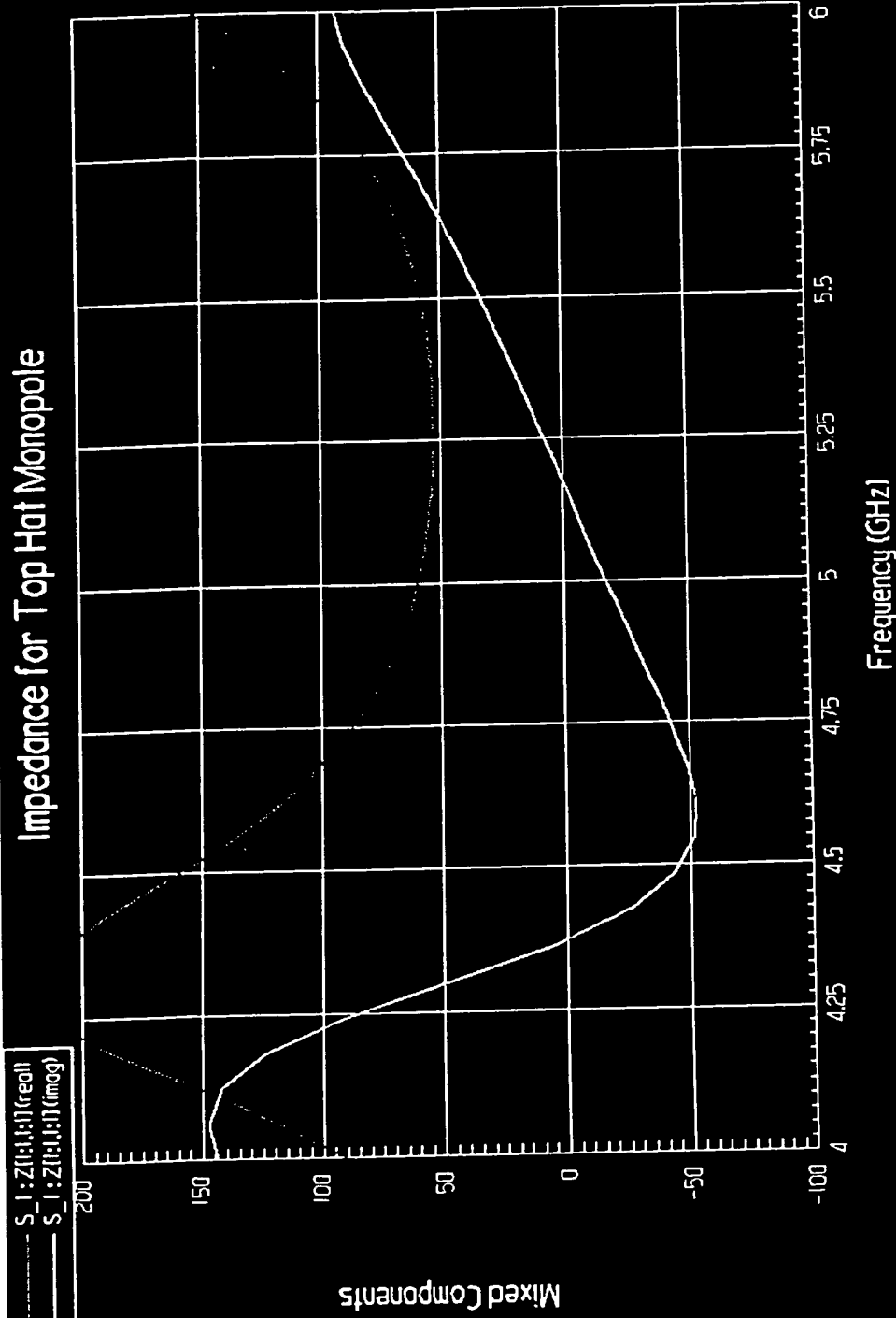


FIG. 34

## Input Impedance

# Impedance for Top Hat Monopole



APPROVED FOR RELEASE BY NSA ON 08-28-2013 pursuant to E.O. 13526

# 50 ohm VSWR

VSWR for the Top Hat Monopole

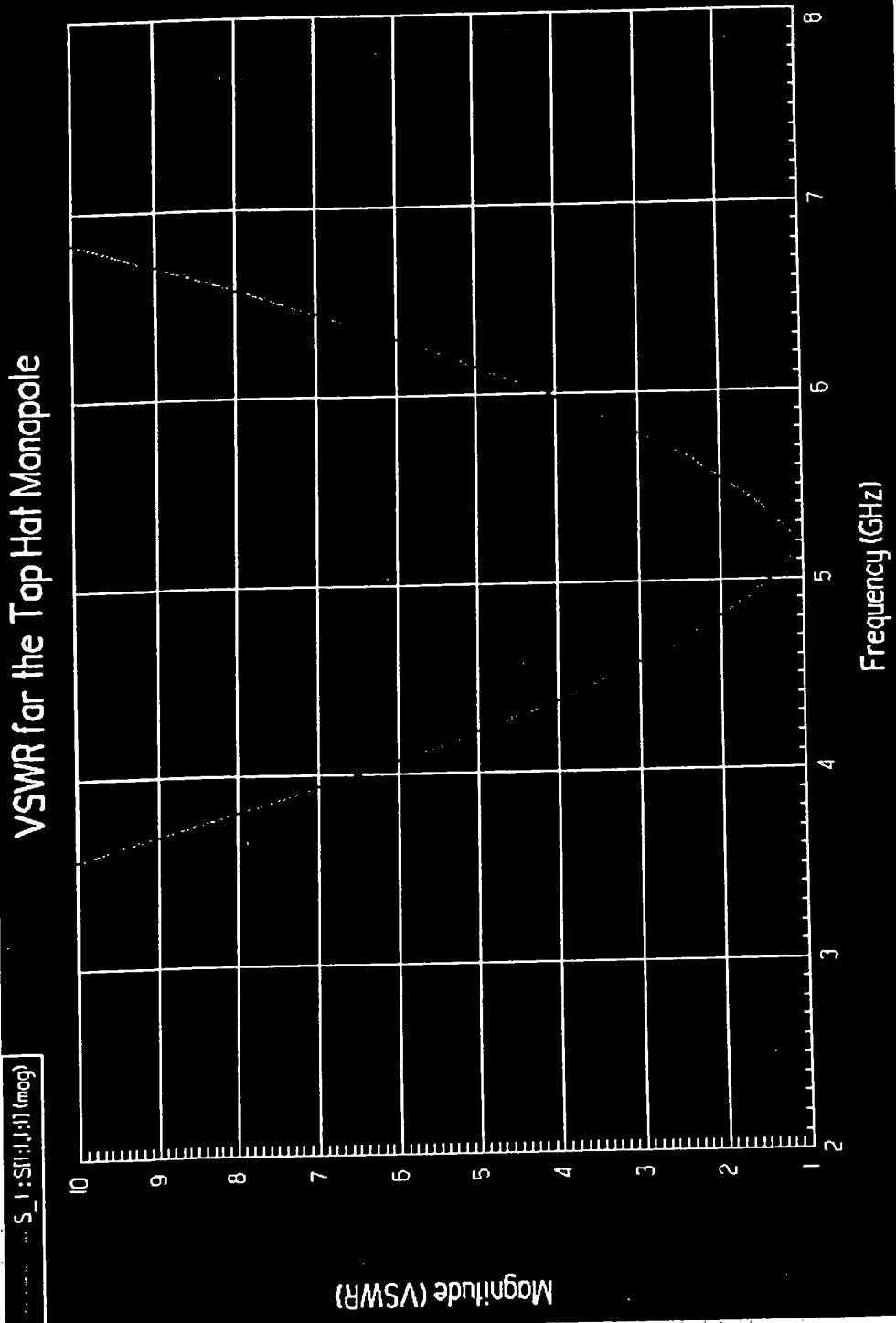


FIG. 36

[illegible]

50 ohm VSWR

# VSWR for the Top Hat Manopole

